I. Perfusion Analysis with Automated AIF selection

The automated perfusion analysis provides the user with the option of running automated perfusion analysis on DICOM data, AVW data, as well as data displayed in MEDx on a group page (Figure 1). The user specifies the DICOM perfusion study and the directory in which he/she wants to save the results. Initially, the study is saved as AVW in the specified output directory under a subdirectory named *patientname_studydate*. The arterial input function (AIF) is automatically determined based on an estimation of the arrival time and standard deviation calculations. The method adopted for the calculation of the AIF in the script is different from the one used in the perfusion module of MEDx. The details of this more recent method can be provided upon request. Subsequent to determination of the AIF, the program automatically runs a perfusion study and saves the results in the output directory.

Step 1:   Start MEDx. Open a New Folder Go to **Toolbox -> Volumetric** and select **Automated Perfusion Analysis**. The following GUI for the automated perfusion analysis should come up where the default option is **DICOM From Scanner**.
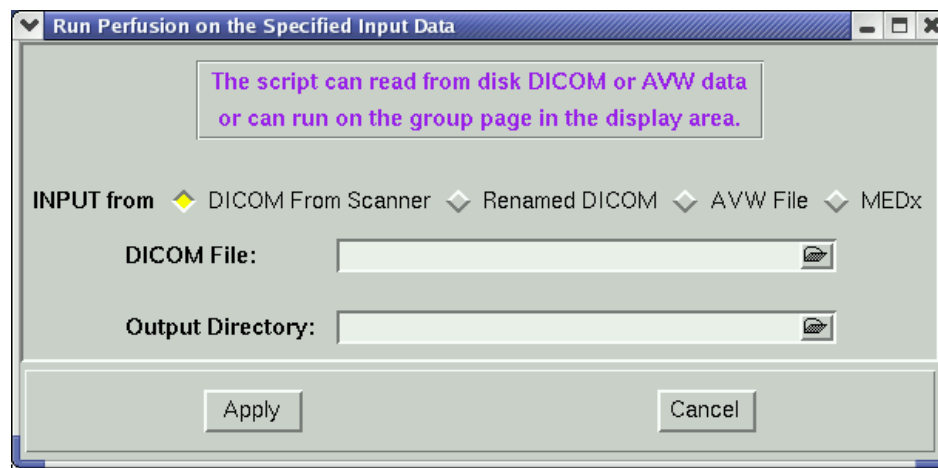

Figure 1. GUI for running automated perfusion analysis with DICOM data

Step 2:   The difference between the **DICOM From Scanner** option and the **Renamed DICOM** option is that the former expects a subdirectory structure based on *.STU and *.SER endings. The latter can handle all types of DICOM studies provided that the specified file can be opened in one volume i.e. the study does not have multiple series. Select the appropriate DICOM option. Specify the DICOM perfusion study and the directory to save the results in. Sample DICOM studies are available in images/tutorials/DICOM directory. The TR and TE of the acquisition are obtained from the DICOM header. Press on **Apply**. At the conclusion of the analysis there will be a number of images in the results directory under the newly created *patientname_studydate* subdirectory.

Step 3:   Now select the **AVW File** option. The TR and TE of the acquisition can no longer be obtained from the header The additional options in the GUI (Figure 2) prompt the user to specify the TR and TE.
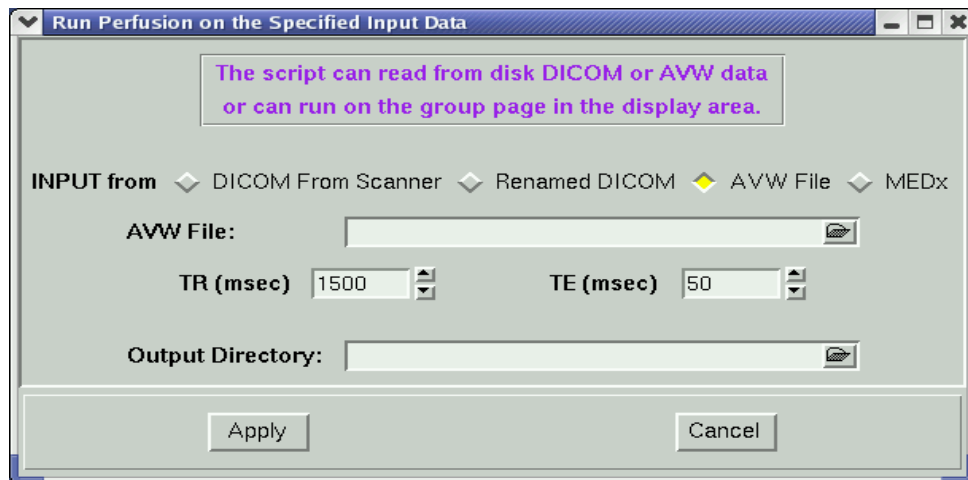
Figure 2. GUI for running automated perfusion analysis with AVW data

Step 4: Specify an AVW perfusion study and a different output directory for the results. Sample AVW perfusion sets are available in $PXHOME/images/tutorials/AVW. Press on Apply.

Step 5: Now select the MEDx option from the GUI. You will see instructions on the GUI to open a group page in the display area (Figure 3).
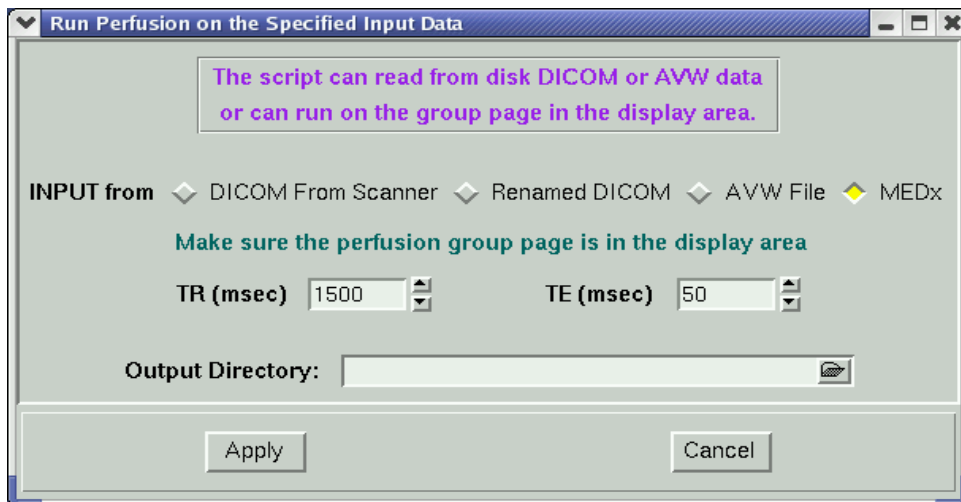

Figure 3. GUI for running automated perfusion analysis on displayed group data

For this portion it should be immaterial whether the displayed group page comes from a DICOM file, an AVW file, or from another file format. The specified output directory should preferably be different from the ones used for the previous options. Specify the TR and TE. Press on Apply.

Step 6: In each of the above cases, the results can be viewed separately. Within the specified results directory, for each case, under the *patientname* subdirectory, you will find the results of the perfusion run, namely the CBF, CBV, MTT, time-to-peak (TTP), and AreaOverPk images along with an image that has an overlay of the artierial pixels used for the analysis. Finally, an artery map can be obtained by subtracting the images that have "BASE" and "TA" in their names.

Step 7: The results of each of the previous runs can be checked in a separate folder. Open a **New Folder**. Go to **Image -> Open Image**. Across **Filter** specify the Directory the results were saved in. Go to the subdirectory associated with the current study. Select the image that starts with *Overlay…* Press on **Apply**. Now go to **Display -> Apply LUT**. Under **LUTs**, select *HotIron*. The voxels that contributed to the AIF will be highlighted in red. You can open the *CBV*, *CBF*, *MTT*, *TTP* (time-to-peak), and *AreaOverPk* images one-by-one to examine the contents. Finally to view the general arterial map that formed the basis for the overlay image, open the images that have "BASE" and "TA" in their names. Then subtract the images using the calculator. Across **Output Image** select *New Image*. Across **Name**, specify *Artery Map* and across **Type**, specify *Real 32*. Press on the **Select** button and go to **Page-> Page Manager**. Specify the "TA" image followed by "-" followed by the "BASE" image. Then press on **Apply**. The result of the subtraction will highlight the main arteries of the brain.